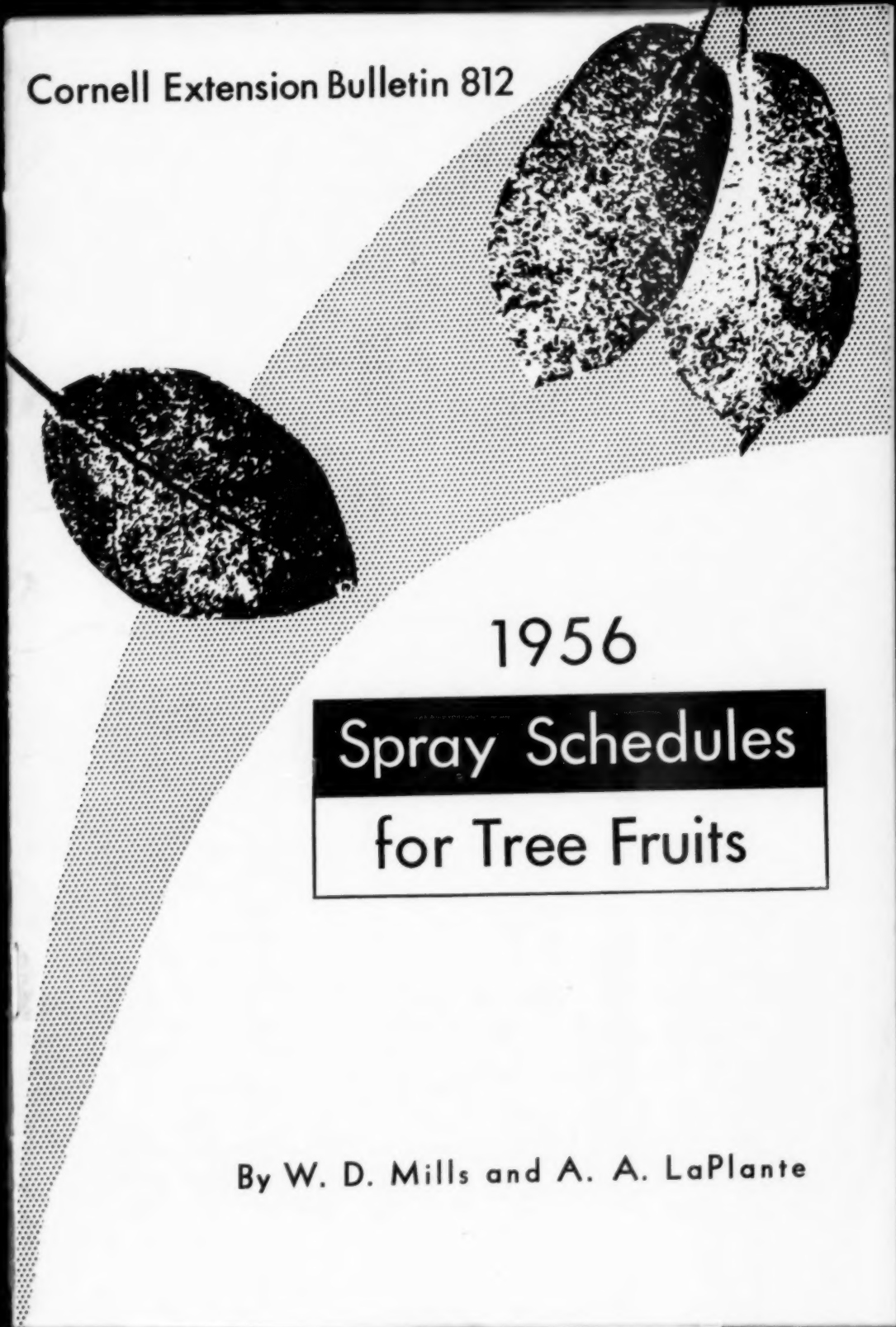


Cornell Extension Bulletin 812



1956

Spray Schedules
for Tree Fruits

By W. D. Mills and A. A. LaPlante

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1956

Spray Schedule for Tree Fruits

W. D. MILLS AND A. A. LAPLANTE

THE important facts concerning the practical control of orchard diseases and insects by spraying and dusting under New York conditions are given in this bulletin. Only spray schedules based on the latest published and unpublished data of the research workers of the state experiment stations and the authors' observations of practices followed by successful fruit growers are given. It has been prepared after conferences with the members of the experiment stations at Geneva and Ithaca.

APPLES

THE MOST important problems are apple scab, codling moth, apple maggot, plum curculio, red-banded leaf roller, orchard mites, and aphids. Occasionally, cedar rusts are of major importance either locally or generally throughout the region. Powdery mildew has recently become a serious problem in some western New York orchards. Other diseases and insects are restricted in importance to more or less definite areas. Because of these variations in importance of the different insects and diseases with locality and year, the following schedule must be considered as a general outline of the spray program to be modified to meet the actual conditions in the orchards to be treated. In counties where the Extension Service conducts a spray-information service, valuable assistance in adapting the general recommendations to individual needs may be obtained on request.

PARATHION AND EPN ON MCINTOSH AND ITS RELATIVES

Parathion and EPN are valuable insecticides but may cause injury on McIntosh, Cortland, Kendall, McCoun, Milton, and other varieties of McIntosh parentage.

Parathion

Parathion when used without charcoal may injure foliage at any recommended dosage if applied during the time of first leaf appearance (green-tip stage) to approximately 2 to 3 weeks after petal fall. The fruit may be

injured at any time after the petal-fall stage at dosages higher than $\frac{1}{2}$ pound of 15 per cent wettable powder. Experiments and practical usage have demonstrated the value of correcting this injury by using a spray grade of activated charcoal. It is suggested that $\frac{3}{4}$ pound of charcoal be used with each pound of parathion on these sensitive varieties by those growers who desire to use parathion in their schedules. Under extremely favorable conditions, such as in 1953, there may be slight to moderate foliage injury even with the charcoal. The tender leaves on the terminals become blackened on the edges and become "goose-necked." Such injury may occur any year and has been noticeable in one year out of the past five. Increasing the amount of charcoal is not advisable. Fruit injury on McIntosh and Cortland has not been observed where charcoal has been used.

The use of charcoal after the second cover spray is *not* suggested since an undesirable residue results. Experiments show that insecticidal efficiency is not harmed by the addition of charcoal.

EPN

EPN causes fruit and foliage injury similar to parathion. At present there is no known way to correct this injury. Therefore it is recommended *not to use EPN on McIntosh and its relatives.*

SPRAY OUTLINE

Dormant spray

(After the buds have begun to swell but before they show green at the tip)

The preferred time for application of the dormant spray is after the buds have begun to swell but before they show green at the tip. Weather conditions and condition of the orchard often interfere with this ideal timing, and many growers find that DNC¹ materials are more readily applied in the fall. It is not considered good practice to apply the DNBP² materials in the fall because injury can be severe under certain conditions.

Rosy aphid adults cease laying eggs after the temperature has dropped to 20°F. or below for a few hours. Egg-laying activity also ceases after the leaves have fallen from the trees. DNC sprays may be applied either after egg laying has ceased or after leaf fall but for maximum safety it is best practice to wait until all or most of the leaves are off.

Recommended rates of DNC materials for 100 gallons of spray are: for **aphid control**, $1\frac{1}{2}$ quarts or pounds; for **bud moth** and **oystershell scale control**, from 3 to 4 quarts or pounds.

¹ DNC contains dinitro ortho cresol. Sold in liquid and powder form in New York State as Elgetol, Krenite, DN Dry Mix No. 2, Dinitro Dry, Ortazol powder, and the like.

² DNBP contains dinitro secondary butyl phenol. Sold in New York State as DN-289 or Elgetol 318.

Recommended rates for DNB materials are for each 100 gallons of spray: 1 quart for aphids and 2 quarts for **bud moth**, **San Jose scale**, and **scurfy scale**. **Oystershell scale** requires from 3 to 4 quarts.

DNB materials should not be used when any green tissue is showing. DNB materials have been used up to $\frac{1}{8}$ inch of green tissue showing without apparent harm, but this is not considered good practice and should be resorted to only in an emergency.

DNB sprays have some effect on overwintering European red mite eggs, but not enough to depend on them for seasonal control.

Semi-dormant sprays (silver tip, green tip, and delayed dormant)

Silver-tip stage

(When the blossom buds begin to swell showing silvery tips)

The first danger of apple-scab infection is on the sepals when the fruit buds are in the silver-tip stage. Sepal infection is occasional in western New York and was general in that area in 1951, and there was some infection in 1954 and 1955. Sepal infection is rarer in the Hudson Valley. There were, however, small amounts in the southern end of the Hudson Valley in 1952 and considerably more in 1953 and 1954. The development of the apple-scab fungus is closely followed in both areas, and the growers are notified if scab spores are mature and if silver-tip or early green-tip infection is possible. Under such circumstances an additional early application of fungicide may be required for scab control in addition to the bordeaux mixture commonly applied in the green-tip or delayed-dormant stage. (Refer to disease control, page 18.)

Green-tip stage

(When the blossom buds are bursting and show from $\frac{1}{8}$ to $\frac{1}{4}$ inch of green color)

and

Delayed-dormant stage

(When the leaves of blossom buds are out from $\frac{1}{4}$ to $\frac{1}{2}$ inch)

The most important disease to control through this period is **apple scab**. The control of such insects as **European red mite**, **fruit-tree leaf roller**, **red bug**, **scurfy scale**, and **San Jose scale** may also be obtained at this time with dormant superior oil.

Bordeaux mixture	2-4-100
"Superior" type oil	2 gallons
Blood albumin	2 ounces
Water to make	100 gallons

Best results have been obtained by emulsifying oil sprays in the spray tank. A suitable emulsifier is blood albumin used at the rate of 2 ounces of actual blood albumin to 100 gallons of the spray mixture. Only the blood albumin that is soluble in water should be used. Those that form only a temporary suspension and settle to the bottom after being shaken vigorously in a container of water are unsatisfactory. Suitable commercial brands that contain 2 ounces of actual blood albumin in $\frac{1}{2}$ pound of finished product are available.

Bordeaux mixture is usually added for protection against early scab infection. It is preferable to emulsify the oil with bloom albumin and then to add the 2 pounds of powdered copper sulfate and 4 pounds of lime to form the bordeaux mixture rather than to emulsify the oil with the bordeaux mixture. Bordeaux oil does not redistribute, and new growth must be protected by a fungicide before the next rain.

More than one spray may be required during this period for **apple scab** control. The above formula containing oil and bordeaux mixture should, however, be used only once. It has been shown that **European red mite** control is effective at any time during the green-tip or delayed-dormant period and it is therefore merely a convenience to use the bordeaux-oil formula. Where oil is not used, in other words where additional **scab** treatments are required, one of the following may be applied:

Lime-sulfur	2 gallons
or	
Elemental sulfur at manufacturers' directions	
Water to make	100 gallons

In the Rome, Jonathan, Cortland, Baldwin, and Monroe varieties, sulfur sprays are preferable to the organic fungicides: captan, ferbam, and glyodin are all ineffective for **mildew** control. The only organic fungicide so far demonstrated to be effective in mildew control is dinitro capryl phenylcrotonate sold as Karathane. One pound per 100 gallons is needed for mildew control. This fungicide is inferior to the other fungicides mentioned above in **scab** control and the addition of a scab fungicide is needed.

If a **San Jose scale** problem exists, the 2 gallons of oil in the bordeaux-oil formula will be enough. If **scurfy scale** is a problem, 3 gallons of oil are needed.

If a DN spray was omitted or could not be applied for aphid control, BHC may be used at the rate of 2 pounds of a 10 per cent gamma isomer powder or the equivalent in other strengths or lindane at 1 pound of the 25 per cent powder in the bordeaux-oil formula. Best results are obtained

at the full delayed-dormant stage; but to prevent injury from the bordeaux-oil formula, spraying should be completed before the leaves roll back and expose the blossom buds. This spray is not so efficient as a dormant DN spray for aphids and is ineffective against **bud moth**.

Combined aphid and bud-moth control may be had with a material called *malathion* which shows promise for this purpose. It is used at the rate of 2 pounds of the 25 per cent wettable powder. Parathion may be used for this purpose in extreme emergency at the rate of 1 pound of 15 per cent wettable powder, but the importance of scab control at this time does not warrant its use. If a ferbam-oil mixture is used rather than a bordeaux-oil mixture, TEPP may be used to control aphids alone. None of these materials controls oyster-shell scale.

A substitute program for superior oil using ovex is recommended at the rate of $\frac{1}{4}$ pound in the pink spray and $\frac{1}{2}$ pound in the pre-cover spray, the second cover spray, and the fourth cover spray. This program also has some value against early two-spotted and four-spotted mites but is ineffective against all other pests.

Pre-blossom sprays

Elemental sulfur at manufacturers' directions

or

Lime-sulfur 2 gallons

Water to make 100 gallons

The pre-blossom spray or sprays, applied between the delayed-dormant spray and the bloom, are timed primarily for **scab** control. The points to be considered in timing the applications are: the occurrence of rain periods, the amount of new growth, and the stage of development of the scab fungus. In some seasons, two or more pre-blossom applications may be required for effective **scab** control, especially on extremely susceptible varieties such as McIntosh.

Dusting or spraying with elemental sulfurs during rain may be a valuable aid in **scab** control. Both are effective if properly applied. The paste sulfurs are especially valuable for sprays during rain, but the dry wettable sulfurs may also be used. The addition of 1 pound of hydrated lime increases the effectiveness of both forms. An oil type of sticker increases the deposit of sulfur during a rain, but the paste sulfurs give excellent control at from 10 to 12 pounds in 100 gallons of spray without a sticker. Sulfur dusts are effective also during rain, but usually an application must be repeated for protection through the next rain. The finest divided dusts are most effective and the addition of wetters or stickers to the dusts has not

been shown to increase effectiveness. The effective use of these materials during rain is discussed in Cornell Extension Bulletin 630, *Efficient Use of Sulfur Dusts and Sprays during Rain to Control Apple Scab*.

The phenyl mercury compounds and dichlone (Phygon) may also be used in rain or after rain. Both materials give some degree of after-rain control as does lime-sulfur but both are inferior to lime-sulfur or elemental sulfur applied before the rain periods. Lime-sulfur is an excellent protectant and a good after-rain treatment but should not be applied on wet foliage during bloom or during or preceding very high temperatures. Mercury sprays are also dangerous at those times. In past years, the mercury sprays in bloom have apparently caused no injury to foliage, fruit set, or to bees. In 1953, however, serious reduction in set followed bloom sprays of mercury.

The combination sprays of half strength mercury with half strength of glyodin, ferbam, captan, or sulfur reduce but do not eliminate the injury by mercury.

Post-bloom sprays of mercury preceding or during hot weather have caused leaf injury and drop, and in some instances fruit drop as well. Mercury should not be used after the petal-fall spray. Dichlone in a seasonal schedule has caused a serious reduction in bloom and fruit set the following year. Its use should be limited to occasional pre-cover sprays at low dosages.

Ferbam is safe on apple foliage but has caused considerable enlargement of fruit lenticels and some russetting. Ferbam is inferior to sulfur paste as a protectant against leaf scab but at 1½ pounds per hundred gallons equals 5 pounds of sulfur in control of fruit scab.

On red and Golden Delicious, captan (Captan 50W and Orthocide) has usually given higher finish than any other fungicide for the past three years.

In 1953 serious fruit russet on Delicious and Stayman was reported in the Hudson Valley from captan at 4X. Considerable leaf spotting of Delicious and Baldwin again appeared in 1954 and 1955 soon after the petal-fall stage, following pre-bloom and bloom sprays of captan. This injury by captan was more severe on Delicious trees receiving a bordeaux-oil spray in the green-tip or delayed-dormant spray. In most instances the leaf injury to Delicious and Baldwin was not serious. Captan possesses some after-rain effect against scab infection but cannot be relied upon more than 18 hours from the beginning of the rain. Sulfur sprays immediately preceding captan increase the injury by captan to susceptible varieties.

Glyodin (Crag 341) is an effective protectant against apple scab, at 1 quart per 100 gallons during primary scab, and from 1 to 1½ pints later. Glyodin should not be used on apples in New York State at the rate of more than 1 quart per 100 gallons. Some late leaf injury has appeared on Rhode Island Greening, Baldwin, and Cortlands sprayed with glyodin and lead arsenate. The spotting was late in the summer and did not appear to be

important. Glyodin and DDT combinations did not cause the leaf spotting. The mixture of 1 pint of glyodin with half strength mercury has given excellent control when combined protection and after-rain control were needed. This mixture has caused no injury to foliage or fruit in pre-cover sprays during the past five years.

Iron sulfate used as an arsenical corrective with glyodin-lead mixtures caused varying amounts of russetting in 1955.

For eradication of new leaf scab lesions, DN Dry Mix No. 2 ($\frac{1}{2}$ pound in 100 gallons of spray) with lime (3 pounds in 100 gallons of spray) and a spreader have given good results when applied thoroughly and on time. The label of DN No. 2 does not cover this use of this DN material so it cannot be recommended or legally used.

If chewing insects, such as **fruit tree leaf roller**, **green fruitworms**, **tent caterpillars**, **cankerworms**, present a serious threat to the foliage or buds, 2 pounds of 50 per cent wettable DDT powder may be included in the pre-blossom spray. Generally, unless the threat is serious, it is advisable to postpone the use of DDT until petal-fall spray to reduce possible danger to pollinating insects. *Lead arsenate should not be used in this spray* because it poisons pollinating insects. If an insecticide is to be used in this spray, honeybees must be removed from the neighborhood.

Special bloom spray or sprays

Copper sulfate	2 pounds
Hydrated lime	6 pounds
Water to make	100 gallons

or

20-80 copper-lime dust

or

Streptomycin sulfate or nitrate..... 100 ppm

In orchards where blight has been severe, the suggested practice in the past has been to apply two bordeaux mixture sprays or two copper-lime dusts (1) when about one fifth of the blossoms are open and (2) when three-fourths of the blossoms are open. Frequently a single bordeaux spray or copper dust has been applied when three-fourths of the blossoms are open. These copper applications have given very variable control with high control of **blossom blight** in some seasons and poor control in others.

With the evidence available that blossom blight is serious only with maximum daily temperatures above 65°F. and with precipitation or very high humidity, it seems more logical to apply the copper sprays or dusts when such conditions prevail. This practice has increased the control with copper in the northwestern States.

Streptomycin has given excellent control in areas where temperatures are considerably above 65°F. but appears less effective at 65°F. or low temperatures under conditions prevailing in New York for the past two years.

A suggestion for trial use would be to apply the copper spray or dust as soon after the beginning of bloom when maximum temperatures are expected to reach 65°F. with rainfall. With temperatures more than 65°F. and with moisture at any time during bloom, the use of the streptomycin at 100 parts per million would be expected to give better control of blossom blight. Frequently such conditions occur very late in bloom.

Sprays of streptomycin, after bloom when terminal blight appears, have not proved effective enough under New York conditions to justify the high cost. Unless very thorough pruning out of blight cankers is practiced, severe terminal blight may follow from the oozing cankers despite good control of blossom blight by bloom sprays. Blossom blight may also result from heavy ooze spreading from nearby cankers.

The phenyl mercury sprays have been used in earlier limited tests in New York with some control of blight and with no apparent reduction of fruit set. With a reduction in set up to 50 per cent, which occurred in 1953 with mercury sprays in bloom, bloom sprays of mercury in 1956 are not suggested.

The spray application is supplementary to such measures as chemical treatment or cutting out of cankers, pruning out blighted branches and suckers, and breaking off blighted fruit-spurs.

Bloom sprays and dusts of elemental sulfur may be of great value in orchards where **powdery mildew** is a problem.

Ferbam has been shown in Hudson Valley experiments to be much more efficient than sulfur in the control of **cedar rusts**. Where the rusts are serious in the Hudson Valley, $\frac{3}{4}$ pound of this organic compound, with 3 pounds of elemental sulfur in 100 gallons of spray, is suggested for the pre-bloom spray, in a bloom spray, and in the petal-fall and curculio sprays.

In orchards that received the pre-blossom spray some time in advance of the opening of the blossoms or where the pre-blossom spray was omitted, or in seasons when the bloom period is unusually long and rainy, bloom applications of elemental sulfur may be valuable aids in scab control. Yield, however, may be reduced by these bloom applications, and their use is justified only when the amount of bloom and pollinating conditions are adequate and a disease problem exists. *Insecticides should not be included in any bloom application.*

If wet weather prevails during bloom and if **scab** control is doubtful, or if scab spots are present on the leaves, lime-sulfur may be used. With dry weather during bloom and no scab present, elemental sulfur, or one of the organic fungicides listed, is preferred for the petal-fall spray to lessen the danger of spray injury and of reduction in yield by lime-sulfur.



Figure 1. Proper stage to apply green-tip spray



Figure 2. Proper stage to apply delayed-dormant spray



Figure 3. Pre-blossom, earliest stage when only one spray is applied



Figure 4. Pre-blossom, ideal stage to spray if weather permits



Figure 5. Proper stage to apply petal-fall spray

If conditions are favorable for a heavy infection of **scab**, one should spray as much as possible and use dust as a supplementary measure.

Petal-fall and succeeding sprays

In the following pages a basis for choice of materials to combat summer activity of insects is presented. As foliage becomes heavier following the petal-fall stage, closer attention is needed to adjust spray machinery of the air-blast type, particularly where the spray mixture is concentrated, to meet the varied requirements of pests that differ markedly in their habits of attack. If further information is desired on the habits and life histories of insects and diseases in the fruit orchard, one may obtain a copy of Cornell Extension Bulletin 711, *Diseases and Insects in the Orchard*, from the Mailing Room, College of Agriculture, Cornell University, Ithaca, New York. If problems of compatibility between spray materials arise, a chart may be obtained from the same source at cost.

Petal-fall spray

(When the last of the blossom petals are falling)

Before the petal-fall spray is applied, one should remove any honeybees from the orchard and place them at least a mile away.

For protection against **apple scab**, organic fungicide is applied at manufacturer's directions or elemental sulfur at the rate of 5 pounds (actual sulfur) in 100 gallons of spray mixture or 2 gallons of lime-sulfur. The normal practice is to combine fungicide and insecticide in the same tank. In some recent years, even 325-mesh sulfur has given considerable spray injury when applied during or preceding periods of intense heat. The organic fungicides at manufacturer's recommendation seem preferable to the sulfur except in orchards where **powdery mildew** is a problem and where the sulfur is indicated in these orchards.

This spray is very important for the control of many insects and should not be neglected, particularly with respect to the activity of the **plum curculio**. In response to high temperatures after the developing fruit has attained a size of $\frac{1}{4}$ inch, severe egg-laying cuts result in crescent-shaped scars and round feeding punctures. The injury takes place after maximum temperatures reach 75°F. for two or more days in succession.

The basic insecticide in the petal-fall spray is selected as a result of observations on the intensity of plum curculio attack in past years. Following this choice, the control of other insects present in a susceptible stage of development at petal fall should be considered, taking into account the insects already controlled in the dormant, green-tip, or delayed-dormant stages. (Refer to plum curculio control on apples, page 15.)

Provision should be made to control the **European apple sawfly** in or-

chards on Long Island and in Westchester, Rockland, Orange, Ulster, and Dutchess Counties. It has been proved that BHC at the rate of 2 pounds of 10 per cent gamma isomer content, or equivalent strength of the gamma isomer in other formulations, in 100 gallons of dilute spray offers the most effective control when used at the petal-fall stage. Unfortunately, this material gives poor control of the plum curculio, and a more effective one must be added to the BHC in most orchards in this area. Parathion is almost as effective on the sawfly as is BHC, and gives excellent curculio control but offers other problems in the Hudson Valley area that is predominantly planted to the McIntosh variety. Dieldrin at petal fall controls a light infestation of sawfly, but insufficient evidence is available to be certain of its effectiveness under severe outbreak conditions.

Pre-cover spray

(From 7 to 12 days after petal fall)

This spray in previous issues of this Bulletin was termed either the *special scab spray* or the *10-day spray*. For protection against apple scab, organic fungicide at manufacturers' directions or 325-mesh sulfur at the rate of 5 pounds in 100 gallons of spray mixture may be used alone or included with the selected insecticides. In western New York orchards in many seasons, a special spray, applied about two weeks after the petal-fall spray, may be required for control of **apple scab**.

The **plum curculio** is still active at the time of this spray and it affords an opportunity to control the **red-banded leaf roller** by the proper selection of materials. The only curculio program listed in the curculio materials list which is of value in controlling the first brood of this pest is parathion. In fact, parathion at the rate of 1 pound per 100 gallons of dilute spray applied in the petal-fall and pre-cover spray effectively controls the pest. If it were not for the fact that 2 pounds of parathion per 100 gallons of dilute spray are required for curculio control and that curculio is present to some degree in almost all orchards of the State, this program would be useful since 1 pound per 100 gallons of parathion is much less injurious to McIntosh and its relatives than are 2 pounds.

In view of this situation, the standard program for first-brood control of the red-banded leaf roller is DDD (TDE) added to any of the materials in the curculio control selection list at the rate of 1 pound of the 50 per cent wettable powder in 100 gallons of dilute spray in this precover spray only. Special attention should be paid to applying this spray thoroughly to the undersides of the leaves, for this is where the larvae feed exclusively. To prevent damage from succeeding broods, it is important that a first-brood control measure be used in all orchards where it is intended to use DDT in the cover sprays.

Cover sprays

The purpose of the cover sprays is to control **codling moth**, **apple maggot**, **red-banded leaf roller**, and **apple scab**. Orchard mites and the green apple aphid may also become problems.

It is usual to include a fungicide in all summer sprays for **scab control**. The micro-fine paste and air-ground sulfurs cause fruit scald too frequently to be advised in summer sprays. In most years the coarser 325-mesh elemental sulfur can be substituted to reduce the danger of spray injury. In 1952, 1953, and 1955, however, temperatures were so high that the 325-mesh sulfurs also caused injury. One of the organic fungicides discussed on page 19 may be substituted at somewhat higher cost when high temperatures are forecast. In the cover sprays if scab control is good, captan and ferbam may be reduced to 1 pound, and glyodin to 1 to 1½ pints, in 100 gallons of spray.

A summer-spray program of sulfur and lead arsenate usually controls **Brooks fruit-spot**. Small amounts of this disease appeared on susceptible varieties of apples in the Hudson Valley in 1947. In this area, 1 pound of ferbam may be substituted for the sulfur when lead arsenate is not used. Occasionally, one or more special scab sprays of fungicide alone rather than combined with the insecticide are applied during this period if frequent scab rains prevail.

The first cover spray is timed just before the onset of **codling-moth** larval activity on the fruit. Where it is intended to follow a lead arsenate schedule for the control of codling moth, it should be recognized that the first spray for codling-moth control is the petal-fall spray and lead arsenate should be applied at that time before the calyx cup closes. Since lead arsenate has little contact action on the larvae, this is necessary to prevent entry at this point. With most of the other materials in the codling-moth control selection list (page 17), this is not nearly so important since varying degrees of moth kill, egg kill, and contact kill of larvae are obtained.

In eastern New York, it normally requires 6 codling-moth cover sprays to span the period of codling-moth activity. In western New York, 5 are usually applied. This number varies, however, with the material selected as indicated in table 1.

Table 1. Normal interval in days between cover sprays with various materials

Insect	DDT	DDD	Methoxy-chlor	Lead arsenate	Parathion	Malathion
	<i>Days</i>	<i>Days</i>	<i>Days</i>	<i>Days</i>	<i>Days</i>	<i>Days</i>
Codling moth	12 to 14	10 to 14	10 to 14	12 to 14	12 to 14	12 to 14
Apple maggot	10	10	10	12 to 14	3 to 5	2 to 4

Special sprays

In some years late activity of **codling moth**, **apple maggot**, or **orchard mites** requires special treatment during August. These treatments become increasingly uneconomical as the season progresses and should be made only when absolutely necessary. The local county agricultural agent or *Spray Information Service Letters* where available tell when these sprays are necessary.

DUSTING FOR APPLE SCAB

For scab control, experimental work shows sulfur dusts are most effective when applied during rain before infection occurs. The finer divided dusts are more adherent than the coarser forms. For this reason, the grower should insist on a dusting sulfur equal in fineness to the dry wettable sulfur even if the cost is higher.

PLUM CURCULIO CONTROL

Hudson Valley Area

From three to four sprays are needed, beginning at petal-fall stage. With the exception of parathion, the sprays may be timed from 8 to 12 days apart, depending on the frequency of scab rains where the fungicides are involved or of high temperature periods. Parathion should be used in a 7- to 10-day schedule. The sprays that cover the period of curculio attack are normally the petal-fall spray, an intermediate spray called the *first pre-cover spray* (this has been known as the *curculio* or *10-day spray*), and the first cover spray. In some years, when cool weather following the petal-fall stage prolongs the period of curculio activity, a second pre-cover spray may be needed.

Western New York and Champlain Valley

From two to three sprays are needed beginning at the petal-fall stage. The same timing for materials is used as in the Hudson Valley area. In most years two sprays are enough—one at petal-fall and a second spray from 7 to 12 days after petal-fall that might be termed the *first precover spray* or *pre-cover spray*. (This spray in previous issues of this bulletin is termed either the *special scab spray* or the *10-day spray*.) Curculio activity usually has ceased by the time of the first cover spray in this area. Occasionally a prolonged cool spell makes a third spray for curculio necessary.

Materials

All amounts given are in terms of amount per 100 gallons of dilute spray. **Dieldrin** (50 per cent wettable powder) at ½ pound, gives excellent con-

trol. Fruit or foliage injury has never been reported. Dieldrin controls also **European apple sawfly, tarnished plant bug, and tent caterpillars**. *Cautions or suggestions:* Build-up of fruit tree leaf roller should be watched for, also bud moth or other minor pests if oil or DN has been omitted.

Methoxychlor (50 per cent wettable powder) at 3 pounds gives excellent control. No injury has ever been observed in this area. Methoxychlor controls also **fruit tree leaf roller, codling moth, tarnished plant bug, green fruit worms, and cankerworms**. *Cautions or suggestions:* A strong European red mite control program is needed.

EPN (25 per cent wettable powder) at 1¼ pounds gives excellent control. Fruit and foliage injury is severe on McIntosh and its relatives; no correction is known, therefore it is not recommended on these varieties. EPN controls **European red mite, fruit tree leaf roller, green fruit worms, cankerworms, and tarnished plant bug**. *Cautions and suggestions:* Respirator and other human safety measures are required.

Parathion (15 per cent wettable powder) at 2 pounds gives excellent control. Severe injury may occur to McIntosh and its relatives unless ¾ pound of activated charcoal is added to each pound of parathion in the spray tank. Parathion controls also **codling moth, European apple sawfly, European red mite, fruit tree leaf roller, red-banded leaf roller, green fruit worms, cankerworms, tarnished plant bug, and scale insects**. *Cautions and suggestions:* Respirator and all human safety measures are required. Parathion may russet Golden Delicious and reduces efficiency of protective fungicides. Activated charcoal inactivates efficiency of eradicant fungicides. Yield may be reduced by parathion in some years on McIntosh and Cortland.

Methoxychlor (50 per cent wettable powder) at 2 pounds with lead arsenate at 2 pounds. Methoxychlor controls also **codling moth** in the first cover spray.

DDT (50 per cent wettable powder) at 2 pounds and **lead arsenate** at 2 pounds. Poor to fair curculio control, good in light infestations; also controls **codling moth, fruit tree leaf roller, green fruit worms, tarnished plant bug, San Jose scale, oystershell scale, and scurfy scale**. *Cautions and suggestions:* Induces European red mite and red-banded leaf roller build-up.

Lead arsenate at 3 pounds gives poor curculio control (good enough in very light infestations such as are sometimes encountered in the western New York and Champlain Valley areas in isolated orchards). Controls also **fruit tree leaf roller, green fruit worms, cankerworms** and, in light infestations, **codling moth**. *Cautions and suggestions:* Program of value where predators and parasites normally reduced in numbers by all of these other schedules are encouraged.

CODLING-MOTH CONTROL

DDT (50 per cent wettable powder) 2 pounds, or 75 per cent wettable powder $1\frac{1}{2}$ pounds, gives excellent codling-moth control, also controls **apple maggot** and **white apple leafhopper**. Bud moth control is possible with proper timing. *Cautions and suggestions:* Usually there is a build-up of mites and red-banded leaf roller populations when used.

DDT (50 per cent wettable powder) 2 pounds, or $1\frac{1}{2}$ pounds 75 per cent wettable powder plus **Malathion** (25 per cent wettable powder) 2 pounds. Excellent control of codling moth. Of value where it is certain that a population of codling moths has become resistant to DDT alone as in a few orchards in western New York. Also controls **apple maggot**, **European red mite**, **two-spotted mite**, **bud moth**, **white apple leafhopper**. *Cautions and suggestions:* Strains of European red mite may become resistant after several years of use.

DDT (50 per cent wettable powder) 2 pounds or $1\frac{1}{2}$ pounds 75 per cent wettable powder plus **lead arsenate** 2 pounds. Also controls **apple maggot** more effectively than any other material or mixture. *Cautions and suggestions:* Introduced primarily for use during the month of July at 12- to 14-day intervals for combined codling-moth and apple-maggot control.

DDT (50 per cent wettable powder) $1\frac{1}{2}$ to 2 pounds, plus parathion (15 per cent wettable powder) $\frac{1}{2}$ pound. Excellent codling-moth control. The $\frac{1}{2}$ pound rate has never been known to cause fruit injury on McIntosh and its relatives. Controls also **European red mite**, **green apple aphid**, and **two-spotted mite**. *Cautions or suggestions:* Respirator and other human safety equipment *must* be used. This mixture was introduced to reduce visible and actual residues of DDT and is commonly used at the $1\frac{1}{2}$ pound rate of DDT. However, apple-maggot control fails unless there is a very short interval between sprays. At the 2-pound rate of DDT maggot control is possible at 8- to 10-day intervals.

Parathion (15 per cent wettable powder) $1\frac{1}{2}$ pounds. Excellent codling-moth control. The fruit of McIntosh and its relatives may be injured without the addition of $\frac{3}{4}$ pound of spray-grade activated charcoal to each pound of parathion used per 100 gallons of dilute spray. The use of both charcoal and parathion are discouraged after the second cover spray on these susceptible sorts because of either poor finish or danger of injury. Parathion controls also **orchard mites** and **green apple aphid**. *Cautions or suggestions:* Not suggested as a full program but may be used in one or two cover sprays where other insect or mite control is desired, provided DDT or lead arsenate is added for protection against apple maggot or there is a 3- to 5-day interval between sprays.

EPN (25 per cent wettable powder) $1\frac{1}{2}$ pounds. Excellent codling-moth

control. Severe injury is probable on McIntosh and its relatives, and no correction is known at present. Controls also **orchard mites** and **green apple aphid**. *Cautions and suggestions:* Respirator and other human safety measures are required. Not suggested for use on McIntosh and its relatives. Has little or no efficiency on apple maggot.

Methoxychlor (50 per cent wettable powder) 2 or 3 pounds; 2 pounds gives a fair codling-moth control and 3 pounds would be considered good. Used chiefly where it has been selected as a curculio control in the Hudson Valley. When used in the first cover spray for curculio, nothing need be added for codling-moth protection. Also used as a **combined codling-moth and apple-maggot control** in late cover sprays. Not suggested for a full codling-moth program in commercial orchards.

Lead arsenate 3 pounds. Poor to fair codling-moth control. Good enough under the light infestations found in more isolated orchards of western New York and in the Champlain Valley. Controls also **apple maggot**. For use in orchards where codling-moth activity is relatively light, because there are not many days when dawn or dusk temperatures are 60°F. when it is favorable for codling moth to lay eggs. With a straight lead-arsenate schedule, predators and parasites are encouraged to help keep down the populations of mites and red-banded leaf rollers as well as other insects.

DISEASE CONTROL

Disease	Time	Materials (Numbers refer to para- graph descriptions)	Amount per 100 gallons
Apple scab	Dormant to delayed dormant	DNC (Elgetol)	½ gallon (600 gal- lons per acre on ground)

Most effective in severely scabbed, isolated orchards. Not a substitute for the regular tree sprays. DNBP appears slightly less effective than the DNC compounds.

Apple scab	From first green tissue through the primary scab infection	1. Flotation sulfur paste	10 pounds (12 pounds in rain)
		or	
		2. Magnetic 70 paste	7 pounds (8 to 9 pounds in rain)
		or	
		3. Fine dry wettable sulfur	5 pounds (7 to 8 pounds plus oil type sticker in rain)
		or	

4. Lime-sulfur	2 gallons
or	
5. Glyodin	1 quart
or	
6. Captan	2 pounds
or	
7. Ferbam	1½ pounds
or	
8. Sulfur dust	
or	
9. Mercury compounds	Manufacturer's recommendations
or	
10. Dichlone (Phygon)	½ pound
or	
11. Vancide A	1½ pounds

1. **Flotation sulfur** paste is a very effective fungicide for scab control when properly timed in a protective program. It may be used up to and including bloom sprays without reduction in fruit set at the lowest cost of any fungicidal program. In post-bloom sprays, flotation sulfur may cause fruit russetting and reduction in yields. On some apple varieties, all sulfurs have been reported as increasing captan injury in following sprays. Sulfur sprays control **powdery mildew** as well as does the more expensive Karathane where russetting is not a factor.

2. **Magnetic 70** paste is wet-ground elemental sulfur paste. At the same sulfur concentration it is equally effective with flotation paste. Remarks on injury and mildew control apply equally well to Magnetic 70.

3. **Dry wettable sulfurs** may be grouped according to method of manufacture. Micronized sulfur and similar air-ground sulfurs are ground fine by collision or attrition in a high velocity air blast in a closed chamber. Most of the particles are less than 4 microns in diameter. These air-ground sulfurs are also effective in the early season sprays when properly applied in a protective program. Critical tests indicate that most of the dry wettable sulfurs are slightly inferior to the paste sulfurs in scab control.

4. **Liquid lime-sulfur** is an excellent protectant against apple scab and may give after-rain control of scab for 50 hours at optimal scab temperatures and for longer periods at lower temperatures. Lime-sulfur in a seasonal program causes too much injury of foliage and fruit under modern spraying practice. Formation of blossom buds and fruit set are reduced over a period of years. Lime-sulfur causes most injury when applied on wet foliage, during or preceding periods of high temperature, and during bloom. Lime-sulfur has been largely replaced in New York spray schedules by elemental sulfurs and the organic fungicides.

5. **Glyodin (Crag 341)** has been shown to be an effective protectant against scab at 1 quart per 100 gallons during primary scab and 1 pint to 1½ pints in later sprays. It should not be used on apples at dosages of more than 1 quart per 100 gallons.

Glyodin tends to increase arsenical injury on susceptible varieties such as Rhode Island Greening and Cortland and to a much less degree on McIntosh. In 1955, the arsenical injury to leaves was very late in appearing and was not serious where fresh hydrated lime was used at the same rate as the lead arsenate. Promising results in the reduction of arsenical injury by the addition of iron sulfate to glyodin-lead arsenate mixtures in the maggot sprays was reported in 1954 from other States. In the trials in New York of this combination in 1955 there was some russetting of the fruit where the iron sulfate was added in the petal-fall and 10-day sprays. Repeated sprays of the combination which were first used in the 10-day or later sprays did not appear to cause injury. Such mixtures must still be considered only on a trial basis. Glyodin controlled sooty blotch well in 1955.

Experimental evidence in New York indicates glyodin at 1 pint with half-strength mercury was the most satisfactory of the combinations of mercury with protectant fungicide.

6. **Captan (Orthocide 406 and Captan 50W)** still appears to be one of the most effective fungicides. In addition to protective action, captan gives some after-infection control; present evidence, however, indicates that it cannot be relied upon for control when applied 24 hours after the beginning of rain at an average temperature of 50°F. More data on after-rain control with all the organic fungicides are needed. Captan has given the highest finish on Golden Delicious of any fungicide tested. In 1954, there was, however, some russetting on Golden Delicious sprayed all season with captan. It also gives a high fruit finish on Red Delicious, but the present indications are that captan should not be applied to this variety until the third spray after bloom to minimize the danger of early leaf spotting, yellowing, and dropping of this variety. Baldwin appears almost equally susceptible to this injury. Sulfur sprays immediately preceding captan appear to increase injury but injury was severe in a number of orchards of both varieties receiving only captan in the schedule. Bordeaux-oil sprays were shown to increase greatly captan injury in 1953. Captan injury on Delicious and Baldwin has appeared in previous years from the petal-fall and curculio sprays. **Sooty blotch and fly speck** infections were from 95 to 100 per cent in captan-sprayed orchards in Pennsylvania in 1955. Captan gives adequate control of arsenical injury up to 2 pounds of lead arsenate in 100 gallons of spray on apple.

7. **Ferbam** is safe on apple foliage but caused considerable enlargement of fruit lenticels and russetting, particularly on Golden Delicious. No certain differences in various formulations of ferbam were noted in the Hudson Valley in 1954 because the acaricide used with the ferbam caused fruit russetting on all plots. Ferbam is less effective than paste sulfurs as a protectant against leaf scab but at 1½ pounds per 100 gallons equals 5 pounds of actual sulfur in the control of **fruit scab** on McIntosh. It is useful alone or in combination for rust control and sooty-blotch control. Ferbam gives adequate control of arsenical injury up to 3 pounds of lead arsenate in 100 gallons of spray on apple.

8. **Sulfur** dusts are valuable supplements to sulfur sprays in early season applications. Dusting during the rain before infection occurs is the most effective method. The finer divided dusts have been shown to be more adherent and more effective.

9. **Mercury** may be used alone at full strength to give after-rain control for the longest period after infection. The effective period, as with lime-sulfur and dichlone, varies with the temperature; but at any temperature the effective period is longer than with lime-sulfur or dichlone. Mercury, like lime-sulfur, most frequently causes spray injury when applied on wet foliage, during bloom, and during or preceding high temperatures. Foliage injury, fruit russetting, and reduction in blossom formation and in

fruit set may follow. During recent years this reduction has been much more severe than in earlier years. Half-strength mercury with either half-strength sulfur or one of the organic fungicides has appeared to reduce the amount of injury and also reduce the period of after-rain effectiveness. Post-bloom sprays of mercury have frequently occurred during or preceding high temperatures and under these conditions have caused severe leaf injury, leaf drop, and in some instances severe fruit drop. There appears to be little difference between the mercuries in the amount of injury caused. In 1954 tests in the Hudson Valley, seven mercury fungicides all caused considerable russetting when applied to McIntosh on an after-infection schedule. Straight pre-cover schedules of mercury in 1954 again caused considerable foliage injury, reduced fruit set, and caused fruit russetting.

It would seem advisable to limit the use of mercury to a minimum of pre-bloom after-infection sprays when the effectiveness of the protective spray program is in doubt. When the spray can be applied soon after the rain, one of the half-strength mercury combinations is preferable.

10. **Dichlone (Phygon)** in a seasonal schedule has caused a serious reduction in bloom and fruit set the following year. Its use should be limited to occasional pre-cover sprays at low dosages. Dichlone caused serious russetting on several apple varieties in a 1952 test in the Hudson Valley. Apparently this fungicide is less safe under Hudson Valley conditions than in northern New England and in the Champlain Valley. Russetting following Phygon has also occurred in western New York, and to a small extent, in northern New England in 1954.

11. **Vancide A.** In Hudson Valley tests in 1954 this fungicide gave good control of both scab and the **cedar rusts**. Fruit finish of McIntosh, Cortland, Jonathan, and Delicious was good. Reports from some other States have been less favorable and it appears this material is still on a limited trial basis.

Apple scab	Summer applications	8. Sulfur dust	From 1 to 1½
		or	
		7. Ferbam	From 1 to 1½
			pounds
			(Delicious
			1 pound)
		or	(McIntosh
			1½ pounds)
		5. Glyodin (341)	1 quart through
		or	primary
			1½ pints later
		6. Captan (406)	2 pounds
		or	
		3. Coarse dry wettable sulfur (325-mesh)	5 pounds (from 7 to 8 pounds plus sticker in rain)

Fine sulfurs cause too much injury for summer use. Even the 325-mesh sulfur will cause injury if applied during or just before periods of high temperatures.

Apple rust	Green tip through curculio, including bloom	Ferbam alone	(Delicious) 1 pound
		or	(McIntosh) 1½ pounds
		Ferbam	¾ pound plus ½ strength other fungicide
Quince rust	Pink and bloom spray	Same as for apple rust	(Combined rust and scab control)
Powdery mildew	Green tip until mid-June	Karathane	1 pound
		or	
		Sulfur	5 pounds actual sulfur precover sprays
			From 2 to 4 pounds actual sulfur post-bloom sprays

A spreader should always be used when using either Karathane or sulfur to control mildew.

Experiments in other States indicate ¾ pound Karathane is inferior to sulfur in mildew control with the 1-pound dosage about equal to sulfur. Very thorough spraying is essential.

Mildew is becoming prevalent on Jonathan, Rome, Cortland, and Baldwin trees receiving only organic fungicides (captan, glyodin, ferbam, or nabam). Sulfur (5 pounds) and Karathane (1 pound) are equally effective in checking mildew. Neither eradicate. Karathane is expensive, but may give better finish. Sulfur is low priced. Russetting may result from sprays during or preceding periods of high temperature with either sulfur or Karathane.

Fire blight	In bloom (see next page)	Bordeaux mixture	2-6-100
		or	
		Copper-lime dust	20 to 80 pounds
		Streptomycin	100 ppm

In orchards where blight has been severe, the suggested practice in the past has been to apply two bordeaux mixture sprays or two copper-lime dusts (1) when about one-fifth of the blossoms are open and (2) when three-fourths of the blossoms are open. Frequently, a single bordeaux spray or copper dust has been applied when three-fourths of the blossoms are open. These copper applications have given very variable control, with high control of blossom blight in some seasons and poor control in others.

With the evidence available that serious blossom blight occurs only with maximum daily temperatures of 65°F. or higher with precipitation or very high humidity, it seems more logical to apply the copper sprays or dusts when temperatures are near 65°F. with moisture. This practice has increased the control with copper in the north-western states.

Streptomycin has given excellent control in areas where temperatures are considerably more than 65°F. but appears less effective at 65°F. under conditions prevailing in New York for the past two years.

A suggestion for trial use would be to apply the copper spray or dust as soon after the beginning of bloom as maximum temperatures are expected to reach 65°F. with rainfall. If temperatures are well over 65°F. and there is moisture at any time in bloom, the use of the streptomycin at 100 parts per million would be expected to give better control of blossom blight. Frequently such conditions occur very late in bloom.

Sprays of streptomycin, after bloom when terminal blight appears, have not proved effective enough under New York conditions to justify the high cost. Unless very thorough pruning out of blight cankers is practiced, severe terminal blight may follow from the oozing cankers despite good control of blossom blight by bloom sprays. Blossom blight may also result from heavy ooze spreading from nearby cankers.

Brooks	Summer sprays	Ferbam	1 pound
		or	
fruit		Elemental sulfur	5 pounds actual
spot			sulfur

Controlled by sulfur plus lead arsenate. Ferbam is preferable when lead arsenate is not used.

Sooty	Summer sprays	Ferbam	1 pound
		Glyodin	1½ pints
blotch			
Fly	Summer sprays	Elemental sulfur	5 pounds actual
			sulfur
speck			

MITE AND APHID CONTROL

All amounts given are in terms of 100 gallons of dilute spray.

DN-289 or Elgetol 318, 2 quarts. Offers variable control of European red-mite eggs when applied as a dormant spray, but egg kill is not in sufficient numbers to be considered as a program by itself. The partial kill obtained, however, allows the omission of the pink spray in the ovex schedule as an example.

Superior type petroleum oil 3 gallons in dormant or 2 gallons from green-tip to delayed-dormant spray or at manufacturer's directions where a prepared oil is used. This material has long been considered the standard preventive program for **European red mite**. Controls also **San Jose scale**, **lecanium scale**, and **red bug**. At 3 gallons in the delayed-dormant spray or 4 gallons in the dormant spray it controls **fruit tree leaf roller** and **scurfy scale**. *Cautions or suggestions:* Later applications of a mite-control material may be needed in some orchards in seasons favorable to mite development.

Ovex. (50 per cent wettable powder) $\frac{1}{4}$ pound in the pink spray, $\frac{1}{2}$ pound in the pre-cover, second cover, and fourth cover sprays. Introduced primarily as a program to reduce the need for watching mite populations closely. Does not control anything but mites. *Cautions and suggestions:* Gives partial control of **two-spotted mite**. There was some injury in 1954 in the Hudson Valley area in the pre-cover application, and the reason for the injury is still unknown. There was none in 1955.

Note: All of the following programs can be applied to control **European red mite** or the **two-** or **four-spotted mites** as follows: (1) at pink and at petal-fall or (2) in any two applications from 7 to 10 days apart beginning from petal-fall on. It is suggested that if earlier sprays have been omitted for European red mite, that the two sprays of any of the following materials be applied no later than pre-cover and 7 to 10 days later. Those materials that are effective against aphids may be applied as needed.

TEPP, $\frac{1}{2}$ pint of the 20 per cent product or $\frac{1}{4}$ pint of the 40 per cent product. Controls also **aphids** but of little value against other pests. *Cautions or suggestions:* Requires use of respirator and other human safety precautions. Most parathion-resistant mites appear to be resistant to TEPP.

Parathion, 1 pound of the 15 per cent wettable powder. Controls also many other pests, particularly useful for **bud moth** and **aphids**. *Cautions and suggestions:* Injurious to McIntosh and its relatives, useful on other varieties. Respirator and other human safety precautions required. Resist-

ant European red mites have been known to build up when used over a period of years.

Malathion, 2 pounds of the 25 per cent wettable powder. Controls also **aphids**, **bud moth**, and a number of other pests. *Cautions and suggestions:* Safe on McIntosh and its relatives as well as on other varieties. Although a phosphate, malathion is safe to use without extra precautions other than normally expected with most spray chemicals.

Demeton, from $\frac{1}{4}$ to $\frac{3}{4}$ pint of the 22 per cent liquid; $\frac{1}{2}$ pint would be the normal recommendation, although $\frac{3}{4}$ pint may be needed in some instances to extend the systemic action of this systemic chemical. Also controls **aphids**. *Cautions and suggestions:* Respirator and other human safety measures required. Gives more extended protection than most other chemicals because of its ability to enter the plant sap.

EPN, $\frac{1}{2}$ pound of the 25 per cent wettable powder. Of some value against other pests but ineffective as an aphid control measure. *Cautions and suggestions:* Injurious to McIntosh and its relatives and therefore not recommended on these varieties. Respirator and other human safety measures required.

Aramite, $1\frac{1}{2}$ pounds of the 15 per cent wettable powder. Has been consistently effective against the **two-** and **four-spotted mites** but requires hot, dry conditions to work effectively on the **European red mite**. Not effective against other pests. Best material to use where there are finish problems.

Chlorobenzilate, $1\frac{1}{2}$ pounds of a 50 per cent wettable powder. Trial basis. Not of value against other pests. *Cautions and suggestions:* Promising effectiveness against all species of **mites** but has not been used extensively in New York State as yet.

Dimite, 1 pint. Has been erratic in mite control but could be used in some situations.

Glyodin. **Apple scab** control schedule. In a number of instances a program using glyodin has suppressed **mite** populations while it is being applied. *Cautions and suggestions:* Mite populations appear to build up rapidly after the glyodin program has been stopped.

Karathane. **Powdery mildew** control schedule. Has enough action against mites to offer early-season control against **European red mite** but there may be a build-up in populations after the mildew-control schedule has stopped.

TYPICAL SPRAY SCHEDULE—APPLE INSECT CONTROL

A typical spray schedule for control of insects on McIntosh as an example in New York State might appear as follows:

Time	Eastern New York	Western New York
Dormant	DN or substitute	DN or substitute
Delayed dormant	Oil or substitute	Oil or substitute
Petal-fall	Dieldrin plus BHC (BHC for sawfly)	Dieldrin or lead arsenate
Pre-cover	Dieldrin plus DDD	Dieldrin or lead arsenate plus DDD
First cover	Dieldrin plus DDT	DDT
*Second cover	DDT	DDT
Third cover	DDT plus lead arsenate	DDT plus lead arsenate
Fourth cover	DDT plus lead arsenate	DDD
Fifth cover	DDD	DDT
Sixth cover	DDT	

* Mite or aphid control material as needed through the remainder of the sprays.

RESIDUES

In all spraying practices the provisions of Public Law 518, an Amendment to the Food, Drug and Cosmetic Act, must be strictly followed. Legal tolerances guaranteeing the safety of fresh fruit have been set up. Fruit is expected to have residues below these tolerances at harvest time or be subject to seizure by federal or state enforcement agencies. All of the information needed to stay within such tolerances is presented on the labels of the chemicals used for pest-control purposes. The status of dimite, and dichlone (phygon) have not been established and may have to be withdrawn from the recommendations unless tolerances or exemptions from tolerances are granted.

Table 2. Legal tolerances and number of days before harvest materials should be applied to insure residues will be below the tolerance*

Material	Tolerance	Days before harvest
	<i>ppm</i>	<i>Days</i>
DDT	7	30
DDD	7	30
Methoxychlor	14	7
Lead	7	49
Arsenic	3.5	49
Parathion	1	21
EPN	3	21
Malathion	8	3
	(7 days on peaches only)	
Aramite	1	14
Dieldrin	0.1 (?)	60
Chlorobenzilate	5	14
Demeton (Systox)	0.75	21
Ovex	3	45
TEPP	0	3
Captan	25	†
Ferbam	7	†
Glyodin	5	†
Organic mercury	0	†
Zineb	7	†
Ziram	7	†

* Petroleum oil, ryania, rotenone, pyrethrum, sulfur, and copper are exempt from a tolerance and may be used at any time consistent with good agricultural practices.

† Number of days to harvest are not specified for fungicides with the exceptions of mercury compounds which should not be applied after petal fall.

PEAR

A PRACTICAL spray schedule for pears in New York must be built around the control measures required for pear psylla, for this pest is by far the most serious of any to the pear crop. The pear tarnished plant bug, pear midge, stink bug, fruit-tree leaf roller, green fruit-worms, sinuate pear borer, rose leaf beetle, and quince curculio cause damage in some orchards. The most important disease of pears is fire blight, but pear scab, sooty blotch, leaf spot, and *Fabrea* leaf-blight and fruit spot are important in some orchards. The spray schedule includes sprays for all these. All growers

do not have to apply all of the sprays. The grower should, therefore, select from the schedule those sprays needed to protect his particular orchard.

SPRAY OUTLINE

The choice of control measures for **pear psylla** depends upon the availability of materials and upon the experience of the individual grower as to other insect problems in his orchard. A basic schedule consists of a "late dormant" application followed by one or more of the later sprays if necessary.

SPRING APPLICATIONS

Dormant spray

(When the buds are not yet showing green)

Superior dormant oil	3 gallons
Blood albumin (actual)	2 ounces
Water to make	100 gallons

This treatment is made where **pear leaf blister mite** is troublesome.

One pint of nicotine sulfate is added to the oil or used separately if **pear thrips** are a problem. The application is made when the thrips are "swarming" on the opening buds.

Late dormant spray

(From the stage when blossom bud scales are loosened until green leaf tips are showing)

Elgetol, Krenite, or Dinitrosol (DNC materials), 1 gallon in 100 gallons of spray, applied in the green-tip stage controls both **pear psylla** and **sooty blotch**. If sooty blotch is not a problem, either 2 quarts or 2 pounds of a DNC material may be used in this spray to kill pear-psylla eggs. The new DNBP materials (DN-289 or Elgetol-318) may be used against psylla eggs at a concentration of 2 quarts to 100 gallons of spray mixture.

Parathion may be used at 1 to 1½ pounds or EPN at ¾ pound in 100 gallons of spray mixture to kill pear psylla eggs at this time in place of the DN materials. Parathion and EPN appear to be less injurious to the trees and also allow somewhat more leeway in timing the treatment than do the DN materials. These materials are probably not effective against sooty blotch.

Pre-blossom spray

(When the blossom buds begin to separate in the cluster)

A pre-blossom application is necessary only in orchards where **pear scab** or **pear midge** is a problem. For **scab** control, lime-sulfur 1-50 (2 gallons in 100 gallons of water) or a 2-10-100 bordeaux mixture may be used.

Pear scab caused serious loss in western New York pear orchards in 1951, 1952, and 1953. In these orchards, a ground spray was very effective when applied in the spring of 1953. Pear scab was serious in some pear orchards in 1953. A number of orchards received a thorough ground spray of 400 to 600 gallons per acre of a spray containing 2 quarts of paste DNC in each 100 gallons. The spray was applied in the spring of 1953 while the trees were still dormant. The grower then applied the pre-blossom spray and obtained excellent scab control despite complete crop losses from scab in 1952. The ground spray is best applied in the dormant period but may be applied through the green-tip stage. Further discussion of ground sprays are given in Extension Bulletin 711. Nine years experiments with ground sprays for apple scab control are discussed in New York State (Geneva) Agricultural Experiment Station Bulletin 714, *Ground Treatments as an Aid in Apple Scab Control*.

The most effective control for **pear midge** is 2 pounds of DDT powder to 100 gallons of spray applied when the blossom buds are swollen but before the sepals have begun to separate and again 7 days later. At this time the midge flies are usually "swarming" on the trunks and will readily take flight if disturbed. If a fungicide is necessary, elemental sulfur may be used.

Special bloom spray

(When three-fourths of the blooms are open in orchards where fire blight is a problem)

Copper sulfate	2 pounds
Hydrated lime	6 pounds
Water to make	100 gallons

or

20-80 copper-lime dust

One application usually is made when three-fourths of the blooms are open; if **fire blight** has been very severe, an additional early application may be made when about one-fifth of the blossoms are open. The possibility of a reduction of the set of fruit and of fruit russetting by copper applications in bloom should be balanced against the likelihood of blossom infection in deciding whether to apply the material in individual orchards. (See special bloom spray for apple, page 9).

The spray application is supplementary to such measures as cutting out or chemical treatment of cankers, pruning out blighted branches and suckers, and breaking off blighted fruit spurs. These control measures are discussed in detail in Cornell Extension Bulletin 966, *Fire Blight of Pome Fruits and Its Control*.

Petal-fall spray*(When the last of the petals are falling)*

Elemental sulfur at manufacturers' directions	
Parathion	1 to 2 pounds
Water to make	100 gallons

The parathion in the formula is effective against **false tarnished plant bug**, **fruit tree leaf roller**, **green fruit worms**, and **plum curculio**. DDT, lead arsenate, and lime, 2 pounds of each, may also be used for control of the pests mentioned. In orchards where pear psylla is the only problem, this petal-fall spray may be omitted.

Bordeaux mixture, 2-10-100, may be used in place of the elemental sulfur to control **pear scab**, and nicotine sulfate, 1 pint in 100 gallons of spray, may be used with bordeaux to control **false tarnished plant bug**. Lead arsenate, DDT, or parathion may be used with the bordeaux.

Insecticides should not be used on open blossoms.

First-nymph spray*(About a week to 10 days after the petals have fallen)*

Elemental sulfur at manufacturers' directions	
Parathion	1 to 2 pounds
Water to make	100 gallons

This spray is made especially for **pear psylla**, but also furnishes protection against **plum curculio** and **pear scab**. Any one of the formulas listed under early summer sprays may be used where **pear psylla** alone is a problem.

Special spray for rose leaf beetle, quince curculio, and sinuate pear borer
(About June 10; usually necessary only in eastern New York orchards wherever these pests may be a problem)

Lead arsenate	3 pounds
Hydrated lime	3 pounds
Spreader	½ pound
Water to make	100 gallons

If **sinuate pear borer** is a problem, the lead arsenate and lime are increased to 5 pounds each, or 2 pounds of **DDT** is added to the spray mixture.

SUMMER SPRAYS

(When *psylla* becomes threatening)

Early summer sprays

(In July when most of the second-brood *psylla* eggs have hatched)

At this time any one of three mixtures may be used for **pear psylla**:

- | | |
|---|-------------|
| 1. EPN | ½ pound |
| Water to make | 100 gallons |
| 2. Parathion (15 per cent wettable powder) .. | 1 pound |
| Water to make | 100 gallons |
| 3. Malathion | 2 pounds |
| Water to make | 100 gallons |

Elemental sulfur may be added to all formulae where **pear scab** is a problem.

Excellent control of **sooty blotch** and of **Fabreaea leaf and fruit spot** may be obtained by the use of 1 pound of ferric dimethyldithiocarbamate (ferbam) to 100 gallons in the summer sprays.

Late summer spray

(Early in August if *psylla* becomes abundant and threatens to smut the fruit or if the second-brood codling moth is a problem)

In areas of New York where **codling moth** is troublesome, late injury may be prevented by using a mixture of 1 pound of 50 per cent DDT and 1 pound of parathion or 2 pounds of DDT where *psylla* is not a problem. Where codling moth is not a problem, the DDT is omitted. If DDT is omitted any of the formulas given under early summer sprays may be repeated at this time if necessary for *psylla*. The spray usually is applied during the first two weeks of August.

CHERRY

UNDER New York conditions, cherries are sprayed principally to control **leaf spot**, **brown rot**, and **fruit flies**. In some locations the **plum curculio** may require attention. **Black cherry aphid** is confined as a pest mostly to sweet cherries.

SPRAY OUTLINE FOR SOUR CHERRIES

Pre-blossom spray for sour cherries

(Just before the blossoms open)

Lime-sulfur	2½ gallons
or	
Elemental sulfur (actual sulfur)	5 pounds
or	
Captan	2 pounds
Water to make	100 gallons

This spray is applied for the control of **brown-rot blossom-blight**. It is important in most seasons on English Morello, and may be needed in some years on Montmorency cherries. Promising results were obtained with captan against brown rot blossom blight in sweet cherries.

Petal-fall spray for sour cherries

(When the last of the petals are falling)

Low-soluble copper at manufacturers' directions plus 1 pound of lime for each ¼ pound of metallic copper in the mixture plus 1 pint of oil type sticker. Lead arsenate, *2½ pounds in 100 gallons of spray, is included.

or

Elemental-sulfur paste	10 pounds
Oil type of sticker	1 pint
Hydrated spray lime	2½ pounds
*Lead arsenate	2½ pounds
Water to make	100 gallons

* Use 1 pound on English Morello to reduce the danger of arsenical injury ("dry-stem").

Fixed coppers give good control and large fruit; but there may be some stem-end injury to fruit. The fixed copper should be used at a rate giving ¼ pound actual copper per 100 gallons of spray. Lime-sulfur (2½ gallons) gives mediocre control, stunts fruit and tree. To prevent stem-end injury, sulfur paste at 5 pounds actual sulfur may be used in the first three sprays if leafspot is not serious. Poor control usually follows if used in all sprays. Glyodin at the rate of 1½ pints to 100 gallons of spray gave excellent **leaf-spot** control and resulted in no injury to sour cherries in the past five years. Higher dosages caused reduction in sugar content in 1950 and 1951. Sugar content was significantly higher in cherries sprayed with 1½ pints of glyodin than with 2 pounds of captan in 1954. Frozen cherries showed no

significant difference in grade in federal inspection between trees sprayed with captan and with glyodin. On November 12, 79 per cent of the leaves were retained with both. Either glyodin or ferbam used in shuck-fall and first fruit-fly sprays will avoid stem-end injury to fruit caused by fixed coppers but will not prevent arsenical dry-stem. The use of one or more sulfur sprays in July reduced **dry stem** in English Morello cherries in 1950. Lime should be used in all cherry sprays in orchards receiving lead arsenate in fruit-fly sprays. Dithane D-14 (1 quart) plus ferric sulfate (5 ounces) has appeared satisfactory in **cherry-leaf spot** control in preliminary work in New York and is considered promising in some other States.

The addition of $\frac{1}{2}$ pound of soybean flour improves the spreading qualities of the lime-lead-arsenate mixture. Parathion or methoxychlor may be used in place of lead arsenate where **curculio** is a severe problem as discussed in the plum schedule on page 42. Elemental sulfur should be used with these materials.

This spray is effective against **leaf spot**, **brown rot**, and **curculio**.

Bordeaux mixture at 1½-6-100 may also be used, but this highly effective fungicide may injure the foliage and dwarf the fruit. Dwarfing of the fruit has followed lime-sulfur applications also. During a four-year test, higher yields were obtained with low-soluble copper and with sulfur paste than with lime-sulfur or bordeaux mixture.

For the grower who uses a dusting schedule, a 90-10 sulfur-lead-arsenate mixture is indicated. If **curculio** is abundant, an 80-20 mixture of the same materials may be used.

Shuck spray for sour cherries

(When the shucks are falling from the fruits that are going to set)

The same suggestions and materials as those mentioned under petal-fall spray apply to the shuck spray.

This spray is effective against **curculio**, **leaf spot**, and **brown rot**.

For dust, an 80-20 sulfur-lead-arsenate mixture is indicated.

Later sprays for sour cherries

These later sprays are for **cherry**, **fruit flies**, **leaf spot**, and **brown rot**.

For canning cherries to be washed

First fruit-fly spray for sour cherries

*(A week after the **fruit flies** have first appeared or about the time Early Richmond first shows a tinge of color)*

The materials and suggestions are the same as those given under the petal-fall spray (page 32).

Second fruit-fly spray for sour cherries

(About 10 days later than the first fruit-fly spray or when Montmorency begins to color)

The materials and suggestions are the same as those mentioned under the petal-fall spray (page 32).

For dust, a 90-10 sulfur-lead-arsenate mixture is indicated. The applications are made at the same times as indicated for sprays; but, if there are heavy rains, extra dust applications should follow them.

Third fruit-fly spray for sour cherries

In most years, a third application is needed 10 days after the second for fruit-fly protection using the same formula as the petal-fall spray.

Parathion, at the rate of 2 pounds of 15 per cent powder, or methoxychlor, at the rate of 3 pounds of 50 per cent powder, may be substituted for the lead arsenate in all three fruit-fly sprays. For the past two seasons parathion has equalled lead arsenate in fruit-fly control in the tests at the Geneva station. Methoxychlor gave poor control in 1954, but in light infestations control may be adequate. These materials are of particular value on the Morello variety where arsenical dry-stem is more often a problem.

After-picking spray

(Soon after harvest)

The choice of fungicides given under the petal-fall spray (page 32) applies for this application. The lead arsenate should be omitted.

For sour cherries to be used as fresh fruit

The schedule outlined for the fruit-fly sprays for sweet cherries should be followed.

FOR SWEET CHERRIES**Dormant spray for sweet cherries**

(Before the buds are open)

The DNC sprays are effective for the control of **black cherry aphid** at the rate of 1½ quarts of a liquid or 1½ pounds of powdered DNC (Elgetol, Krenite, and the like) material in 100 gallons of water.

The newer DNBP materials (DN-289, Elgetol 318) may also be used at the rate of 1 quart in 100 gallons of spray.

Pre-blossom spray for sweet cherries

(Just before the blossoms open)

Lime-sulfur	2 gallons
Water to make	100 gallons

or	
Elemental-sulfur paste	10 pounds
Oil type of sticker	1 pint
Water to make	100 gallons
or	
Captan	2 pounds
Water to make	100 gallons

Promising results were obtained with captan against **blossom blight** in 1953. Buds appeared to be invigorated by this spray.

The pre-blossom spray is for control of **brown-rot blossom blight**. Additional sulfur applications in bloom may be needed. If no dormant spray was made for aphids, an application is needed at the green-tip stage. One pint of nicotine sulfate plus 3 to 5 pounds of potash fish-oil soap, or 1 pound of soap flakes, or 3 pounds of spray lime may be added to the lime-sulfur to spread and activate the nicotine. From $\frac{1}{4}$ to $\frac{1}{2}$ pint of TEPP, 1 pound of parathion, or 1 pound of malathion may be substituted for the nicotine sulfate in the elemental-sulfur formula.

Usually these later sprays are not so effective as the dormant DN sprays for aphid control.

Petal-fall spray for sweet cherries

(for *leaf spot, brown rot, and plum curculio*)

Lime-sulfur	2 gallons
Lead arsenate	2½ pounds
Hydrated spray lime	2½ pounds
Water to make	100 gallons
or	
Elemental-sulfur paste	10 pounds
Oil type of sticker	1 pint
Lead arsenate	2½ pounds
Hydrated spray lime	2½ pounds
Water to make	100 gallons
or	
*Elemental sulfur (actual sulfur)	3 pounds
Ferbam	$\frac{3}{4}$ pound
Lead arsenate	2½ pounds
Water to make	100 gallons

* The sulfur-ferbam mixture gives control of **brown rot, botrytis rot, and leaf spot**. If cool, wet weather prevails in bloom the use of the mixture may be started in bloom.

The addition of $\frac{1}{2}$ pound of soybean flour improves the spreading qualities of the lime-sulfur-lead-arsenate mixture.

Copper sprays are unsafe for use on sweet cherries

Parathion or methoxychlor may be used in place of lead arsenate as indicated in the sour cherry schedule (page 34).

Shuck spray for sweet cherries

(When the shucks are falling from the fruits which are going to set)

The materials are the same as those outlined for the petal-fall spray.

The shuck spray is effective against **leaf spot**, **brown rot**, and **curculio**.

Later sprays

(For cherry fruit flies, leaf spot, and brown rot)

During the past few years the black cherry aphid has frequently required summer control measures. Any one of the following sprays may be used:

- | | |
|----------------------------|-------------|
| (1) TEPP | ¼ to ½ pint |
| Water to make | 100 gallons |
| (2) Parathion | 1 pound |
| Water to make | 100 gallons |
| (3) Malathion | 1 pound |
| Water to make | 100 gallons |
| (4) Nicotine sulfate | 1 pint |
| Soap chips | 1 pound |
| Water to make | 100 gallons |

For sweet cherries to be used as fresh fruit

It is impossible to recommend a spray schedule that always give satisfactory maggot control and at the same time insures freedom from spray residue. The following suggestions are offered:

First fruit-fly spray for sweet cherries

(A week after the fruit flies first appear or about the time Early Richmond shows a tinge of color)

- | | |
|---|-------------|
| Fine ground derris or cubé powder | 2 pounds |
| (containing from 4 to 5 per cent of rotenone) | |
| Wettable sulfur at manufacturers' directions | |
| Water to make | 100 gallons |

Lime, bordeaux mixture, or lime-sulfur should not be used with derris or cubé powder. The paste forms of wettable sulfurs plus a sticker seem superior for this purpose.

Second fruit-fly spray for sweet cherries*(About one week after the first fruit-fly spray)*

The formula is the same as that for the first fruit-fly spray.

Third fruit-fly spray for sweet cherries*(About one week after the second fruit-fly spray)*

The formula is the same as that for the first fruit-fly spray.

For those growers who prefer to make only two **fruit-fly sprays**, it is advisable to use 3 pounds of derris or cubé powder to 100 gallons of spray instead of 2 pounds. Two applications may not give so satisfactory control as three, particularly if there are rain periods. Methoxychlor or parathion may be substituted for the derris on a trial basis if desired (page 34).

For processed sweet cherries that are to be washed

The schedule is the same as that outlined for sour cherries that are to be washed except that the lime-sulfur is reduced to 2 gallons. *Coppers are unsafe for sweet cherries.*

After-picking spray for sweet cherries

The schedule is the same as that outlined for sour cherries (page 34) except that only 2 gallons of lime-sulfur is used and that sulfurs rather than coppers are used for sweet cherries.

PEACH

IN New York the peach suffers severely from **leaf-curl**, **brown rot**, and **scab** and, in certain localities, from the ravages of the **plum curculio**. The **oriental fruit moth** and **peach tree borers** have been major pests of peach and require suitable control measures. **Tarnished plant bug**, **European fruit lecanium**, and **cottony peach scale** are also important in some areas.

SPRAY OUTLINE**Leaf-curl spray***(After the leaves drop in the fall or in the spring before the buds swell)*

Ferbam	1½ pounds
Water to make	100 gallons

or

*Lime-sulfur	6½ gallons
or	
DNC paste	½ gallon
or	
DNC dry wettable	2 pounds

* If San Jose scale is present, 11 gallons of lime-sulfur should be used.

Bordeaux mixture may be used at 10-10-100 in the fall or 6-6-100 in the spring. Injury to peach buds has been reported from a late spring spray of 1 gallon of paste DNC (Elgetol).

The DNP materials (DN-289 and Elgetol 318) are not safe on peaches.

Pre-blossom spray

(When the blossoms show pink or a little earlier if a rain period threatens)

Lime-sulfur	2 gallons
Water to make	100 gallons
or	
Elemental sulfur at manufacturers' directions	
Water to make	100 gallons
or	
Captan	2 pounds
Water to make	100 gallons

This application is made to prevent **brown-rot blossom blight**.

Additional sulfur applications may be needed in bloom or at petal-fall stage. The danger of reducing fruit set by sulfur in bloom should be balanced against the danger of brown rot. Dichlone (Phygon) at ½ pound gave no injury during 1951, 1952, or 1953, but too little blossom blight developed to test its effectiveness. Greenhouse tests indicate Phygon is effective up to 12 hours after the beginning of the rain. Phygon at ½ pound plus half the usual amount of sulfur has given excellent control of brown rot blossom blight of peaches in Pennsylvania and would seem preferable for trial. Promising results were obtained with captan against blossom blight; captan has, however, caused some leaf injury to peaches in later sprays. Peach mildew is on the increase in captan sprayed orchards.

If a dust schedule is followed, an application of dusting sulfur is indicated.

Where **tarnished plant bugs** (which "cat-face" the fruit) are a severe problem, 2 pounds of DDT (50 per cent wettable powder) should be included. DDT should *not* be applied during bloom.

SUMMER SPRAYS

The basic schedule involves the use of the phosphate materials, EPN, parathion, or malathion plus fungicide. It is designed to control all of the major pests of peach and a number of minor pests with the exception of the Japanese beetle. The number of sprays given here have been carefully determined by experimental workers at the Geneva station and represent the minimum number of sprays for a complete peach insect- and disease-control schedule. Home orchardists are advised against the use of parathion or EPN, and should use the safer malathion program.

The following formula should be used in all sprays

Elemental sulfur	5 pounds
or captan	2 pounds
and either	
EPN	¼ pounds
or	
Parathion	2 pounds
or	
Malathion	2 pounds
plus	
Water to make	100 gallons

First curculio or shuck split spray

(When the first shucks are starting to split from the fruits that are going to set)

This spray is important for the control of **brown rot** and **plum curculio**. It also gives partial control of **tarnished plant bugs** where a problem.

The influence of temperature on effective control of the plum curculio is of great importance. Adults are active beginning at shuck split and for a period of 3 to 5 weeks thereafter, depending on area and the number of warm temperature periods. When temperatures of 70° to 75° F. are reached on 2 to 3 successive days, curculio adults become active. If such temperatures are reached just prior to shuck split, then injury can be expected immediately after the fruits are exposed. In such an instance the wise grower is early with his insecticide rather than late. If there is a week of hot weather after shuck split, a 7-day interval is advised, especially where parathion is used. EPN has somewhat longer residual action than parathion and a longer interval appears to be permissible.

Dieldrin may be used in the curculio sprays at the rate of ½ pound of the 50 per cent powder. It does not protect against the oriental fruit moth and borers and the overall program is materially weakened. Its use is therefore not recommended as a general practice.

Second curculio spray

(From 7 to 10 days after shuck-split spray)

The second spray is important for **plum curculio** and **brown rot** as well as for **first-brood oriental fruit moth** and the **lesser peach tree borer**. Spray the trunks and scaffold limbs as well as the fruit and foliage.

Third curculio spray

(From 7 to 10 days after second curculio spray)

A third spray is necessary in eastern New York to continue protection against the **plum curculio**. It is also of value against **brown rot**, **oriental fruit moth**, and **lesser peach tree borer**.

First fruit-moth spray

(From July 7 to July 15)

This first fruit-moth spray provides protection against **oriental fruit moth**, **peach tree borers**, **cottony peach scale**, **European fruit lecanium scale**, and **brown rot**. The spray is applied to trunks and scaffold limbs as well as to the foliage and fruit for maximum results, and is directed to the undersides of the leaves where scale insects are a problem.

Where **cottony peach scale** or **lecanium scale** is a problem, it may be necessary to adjust time of application for maximum control. Parathion or EPN is effective for a period from about 10 days after the beginning of the summer hatch of the crawlers of either scale until completion of the hatch. Where both scales are a problem, a spray at the completion of the cottony peach scale hatch will normally give protection against both species. Malathion is of little value against scale insects.

Second fruit-moth spray

(From August 1 to August 10)

The second fruit-moth spray is important for **oriental fruit moth** and **peach tree borers**. Sprays applied at this time should have low enough residues to constitute no problem on varieties such as Golden Jubilee and those picked later than Jubilee.

Special sprays

A final treatment of elemental sulfur alone at manufacturers' directions should be made just before harvest.

Japanese beetle

As parathion or EPN lose their toxicity to the Japanese beetle within 3 to 5 days, special measures must be taken in areas where the beetle is a problem.

In the southern part of the Hudson Valley where Japanese-beetle infestations are heavy, fruit may require protection from mid-July to mid-August. Zinc dimethyldithiocarbamate (ziram), 1½ pounds in 100 gallons of water, is a good repellent to Japanese beetle and may be substituted in place of the sulfur. If beetles attack the ripening fruit, make a preharvest rotenone spray or dust or a spray of ziram. Further details are given in Cornell Extension Bulletin 770, *The Japanese Beetle*, available from the Mailing Room, New York State College of Agriculture, at Cornell University, Ithaca, New York.

PLUM AND PRUNE

THE main troubles for which commercial growers of plums and prunes find spraying necessary are plum curculio, leaf spot, and brown rot. In some plantings, European red mite, European fruit lecanium, apple maggot, and black knot may require special attention.

SPRAY OUTLINE

SPRING SPRAYS

Green-tip spray

(As the buds are breaking)

Bordeaux mixture	6-12-100
Water to make	100 gallons
or	
Lime-sulfur	11 gallons
Water to make	100 gallons

If black knot is a serious problem, a green-tip spray should be made in addition to the regular shuck and summer sprays on plums and prunes. For the green-tip spray, both bordeaux and lime-sulfur have given good results.

If bud moth is a problem, 1 pint of nicotine sulfate or 1 pound of 15 per cent parathion should be included in the bordeaux formula above.

Pre-blossom spray*(Just before the blossoms open)*

Lime-sulfur	2 gallons
Water to make	100 gallons

or

Elemental-sulfur paste	10 pounds
Oil type sticker	1 pint
Water to make	100 gallons

or

Captan	2 pounds
Water to make	100 gallons

This pre-blossom spray controls **brown-rot blossom-blight**.

First curculio spray*(When the shucks first start to split)*

Elemental sulfur at manufacturers' directions	
Parathion	2 pounds
Water to make	100 gallons

or

Elemental sulfur at manufacturers' directions	
Methoxychlor	3 pounds
Water to make	100 gallons

The first formula is effective in checking **plum curculio**, **leaf spot**, **brown rot**, and **European red mites**. The second formula is of value for **plum curculio**, **leaf spot**, and **brown rot**. The remarks regarding temperatures given under the first curculio spray on peaches (page 39) also apply here. In orchards where curculio is a severe problem, dieldrin may be substituted for parathion or methoxychlor on a trial basis at the rate of ½ pound of the 50 per cent powder.

Second curculio spray*(From 7 to 10 days after the first curculio spray)*

The same choice of materials may be made as in the first curculio spray.

Third curculio spray*(From 7 to 10 days after the second curculio spray)*

A third spray is necessary in eastern New York to control **plum curculio**.

In seasons of extended activity of plum curculio, the third curculio spray may be needed in western New York and a fourth spray may be

necessary in eastern New York, using the same materials and timing. The local county agent or Spray Information Service letter give the details.

Where **lecanium scale** is a problem, a spray using the parathion formula should be applied from 16 to 20 days after the second curculio spray. In other words, at the completion of scale hatch. The undersides of the leaves must be thoroughly covered.

LATER SPRAYS

(Two or three weeks before the fruit ripens)

Elemental sulfur at manufacturers' directions

Water to make 100 gallons

The applications control **brown rot** and **leaf spot**.

For a dust schedule, applications of dusting sulfur are indicated.

In some orchards, the **red-banded leaf roller** builds up in sufficient numbers to require control measures. Where parathion or EPN is used in the curculio spray, the first brood will be adequately controlled. Where methoxychlor or dieldrin is used, 1 pound of 50 per cent DDD powder should be added in the second curculio spray. For second brood control, DDD is used at the rate of 2 pounds of powder during the first week in August. Where DDT is being used for apple maggot control, the DDD may be substituted for DDT. Parathion at the rate of 1½ pounds of the 15 per cent powder is another effective material for the control of leaf roller and also for orchard mites and bud moth.

If **red mite** or **two-spotted mite** become a problem, TEPP may be used at manufacturers' directions or parathion at 1 pound of 15 per cent powder or EPN at ½ pound in 100 gallons. Two applications from 7 to 10 days apart are necessary.

In some orchards, the **apple maggot** causes considerable damage to prunes. In orchards not surrounded or bordered by unsprayed trees, the maggot may be controlled with three to four applications of DDT. Applications of DDT, 2 pounds of 50 per cent wettable powder in 100 gallons of water, should be started about June 20 in eastern New York and about July 1 in western New York and applied at 10-day intervals.

QUINCE

FORTUNATELY, the quince is subject to attack by only a comparatively small number of insects and diseases. In the past the most serious insect enemy has been the **quince curculio**, but the **oriental fruit moth** is now much more destructive. The **red-banded leaf roller** has also caused consid-

erable losses in recent years. Among diseases subject to control by spraying, the most important is **leaf-blight** and **fruit spot**; occasionally the **Brooks fruit spot** may cause serious losses.

SPRAYING OUTLINE

SPRING SPRAYS

Dormant spray

(In the spring before the buds start)

Dormant-type oil emulsion, diluted to contain 3 per cent of oil.

Apply this when **lecanium scale** becomes abundant, or for **European red mite**. Summer measures as discussed under peaches and prunes may be used if this spray is omitted.

Pink spray

(When the blossoms show pink)

Lime-sulfur	2½ gallons
Water to make	100 gallons
or	
3-8-100 bordeaux mixture	
or	
Ferbam	1½ pounds
or	
Elemental sulfur (actual sulfur)	5 pounds

The lime-sulfur gives good control but often causes considerable spray injury. Bordeaux mixture gives excellent control of **leaf-blight** and **fruit spot** but fruit and leaf injury may be severe. Ferbam gives good disease control and sulfur gives fair control. Neither causes spray injury at this time.

Petal-fall spray

(When 90 per cent of the petals have started to wither)

Bordeaux mixture	3-8-100
or	
Ferbam	1½ pounds
or	
Elemental sulfur (actual sulfur)	5 pounds
DDT	2 pounds
Water to make	100 gallons

This spray controls **leaf-blight**, **leaf spot**, **codling moth**, and **oriental fruit moth**.

If **plum curculio** is a problem, 2 pounds of lead arsenate may be added to the formula.

Lime-sulfur should not be used with DDT. When lead arsenate and lime-sulfur are used, 1 pound of lime is added for each pound of lead arsenate.

LATER SPRAYS

The same formula as suggested in the petal-fall spray is advised except that sulfur is not suggested after the petal-fall spray.

The first application is made 10 days after the petal-fall spray. This spray controls **leaf spot**, **leaf-blight**, and **oriental fruit moth**. If **quince curculio** is a problem, 3 pounds of lead arsenate is added to the formula.

Two applications after the petal-fall spray are usually enough to control **leaf spot**, **leaf-blight**, and **quince curculio**.

For the control of **oriental fruit moth** with DDT, from three to four more applications should follow the 10-day spray at 19- to 21-day intervals.

DDD (TDE) may be used in place of DDT during the first two weeks in August at the rate of 2 pounds of 50 per cent powder in 100 gallons of spray to control **red-banded leaf roller**. The DDD should provide enough protection against **oriental fruit moth** without the addition of DDT.

SAFETY WITH INSECTICIDES

THE organic phosphate materials, TEPP, parathion, EPN, and demeton (Systox), are highly poisonous to man if improperly used. The following precautions should be followed when using these materials. In addition, all chemical poisons should be treated with respect.

1. The greatest danger from parathion or EPN wettable powder appears to be in the operation of putting the wettable powder from the bag or can into the spray tank. Be careful at this point.
2. Wear a respirator with a filter for powders and an activated charcoal filter for organic vapors. Check charcoal filter to be sure it is labeled for the phosphate you are using and change after the number of hours specified.
3. Wear natural rubber gloves.
4. Protect the body from wettable powder and from spray drift. Wear rubber or plastic coats or wash your clothes every day.
5. Symptoms of poisoning: headache, nausea, pin-point vision, constriction of the chest.
6. If the above symptoms are experienced, do not delay—see your doctor.

The antidote is atropine sulphate and cannot be obtained without a doctor's prescription. It is wise to have atropine sulphate on hand. If symptoms are experienced, take no more than 2 tablets and then **see your doctor.**

7. Never thin and remove suckers until several days after phosphate applications. Handling insecticides safely is similar to driving an automobile or, handling fire. If certain precautions are followed, these useful instruments and materials can be used to advantage. If misused, they can do serious harm.

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